LEWISTON ORCHARDS IRRIGATION DISTRICT
SWEETWATER CANAL

CANAL LINING DEMONSTRATION PROJECT
Exposed 45-mil Reinforced Metallocene
OCTOBER 24 - 26, 2000

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January 2001

Lewiston Orchards Irrigation District

Serrot International Co.

Bureau of Reclamation

Test Section LO-1.--

Material:	Exposed 45-mil Reinforced Metallocene (mPE) with 8-oz Geotextile Cushion
Date Installed:	October 2000
Location:	Lewiston Orchards, - about 10 miles southeast of Lewiston ID See Figures 1 and 2 (1500 + 300 linear feet, 36,000 square feet)
Description:	The 45-mil geomembrane consists of 2 layers of Metallocene reinforced with a 10 by 10 polyester scrim. The geomembrane is tan on the top side and black on the bottom. Metallocene is a copolymer blend of HDPE and Polypropylene. Material Data sheet is included in Appendix A.
Prime Contractor:	Lewiston Orchards Irrigation District (LOID)
Material Supplier:	Serrot Corporation
Surface Preparation:	The irrigation district performed extensive subgrade preparation by removing vegetation from the canal, restoring the 1½:1 sideslopes (approximate), and cutting a 2-ft wide bench for anchoring on each bank. The cost of subgrade preparation is estimated at $0.26 per square foot to match the subgrade preparation costs on previous similar test sections. The finished canal prism measures 20 to 24 feet across, including the 1 to 2 ft of material buried in the anchor berm on each bank. The finished canal invert measures 6 to 8 feet across, and the 1½:1 sideslopes measure 3 to 4 feet high. Water typically runs about 2 feet deep, and this section of canal typically carries about 23 cfs. Seepage was estimated at .5 to 1 cfs depending on water depth within the canal and is quite evident in one bend where lots of vegetation is growing below the canal. The irrigation district also improved the access road by hauling in rock and gravel, and then grading the road. The road is only on one side of the canal. These costs are not included in the cost estimates.
Construction:	The Metallocene geomembrane is manufactured in 10-ft wide rolls. The roll goods were then fabricated into 30- by 100-ft panels. The panels were folded toward the middle, and rolled onto the 10-ft cardboard core. A trackhoe was used to preposition the panels and geotextile cushion along the canal.

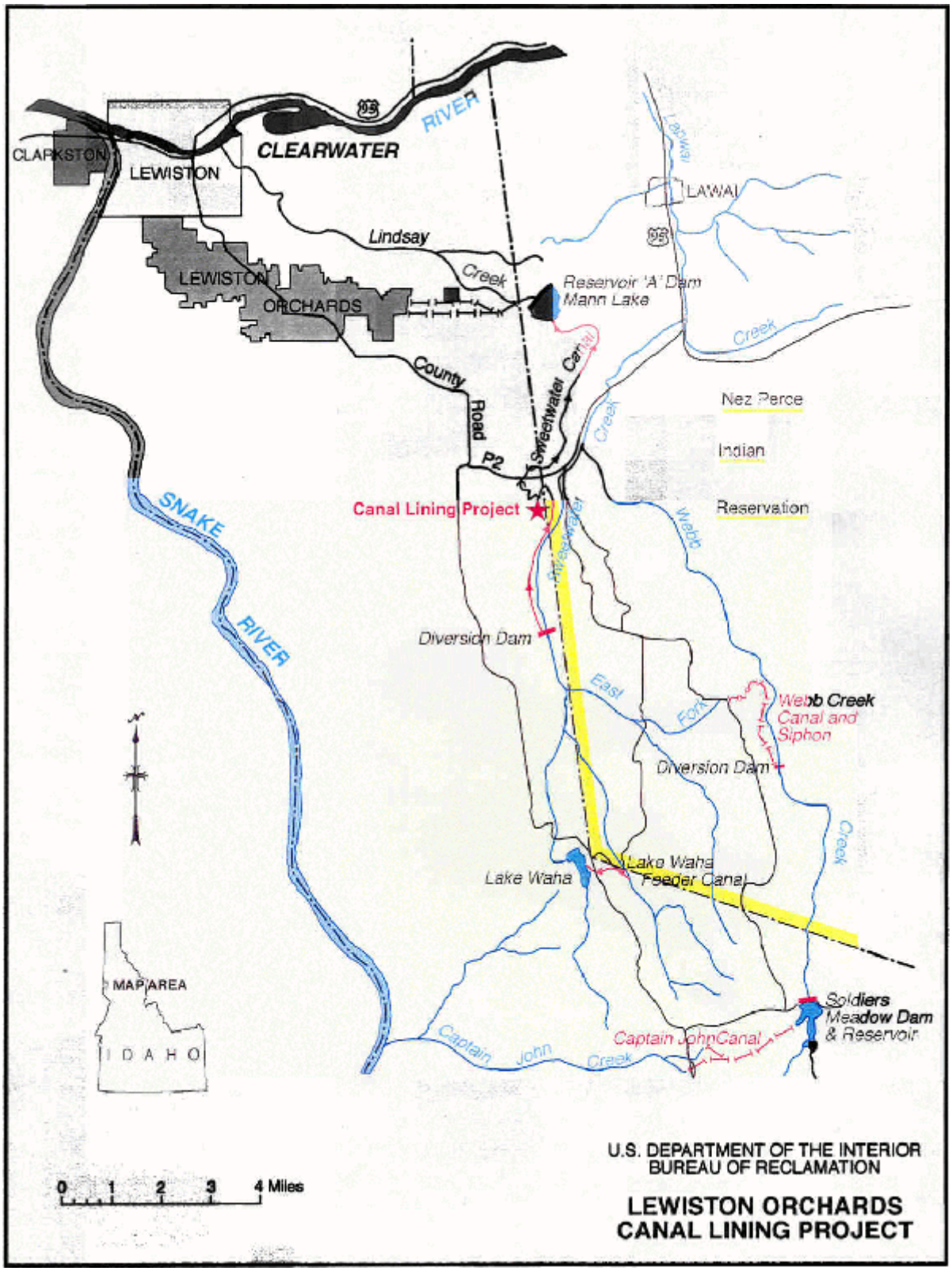


Figure 1 - Project location map.

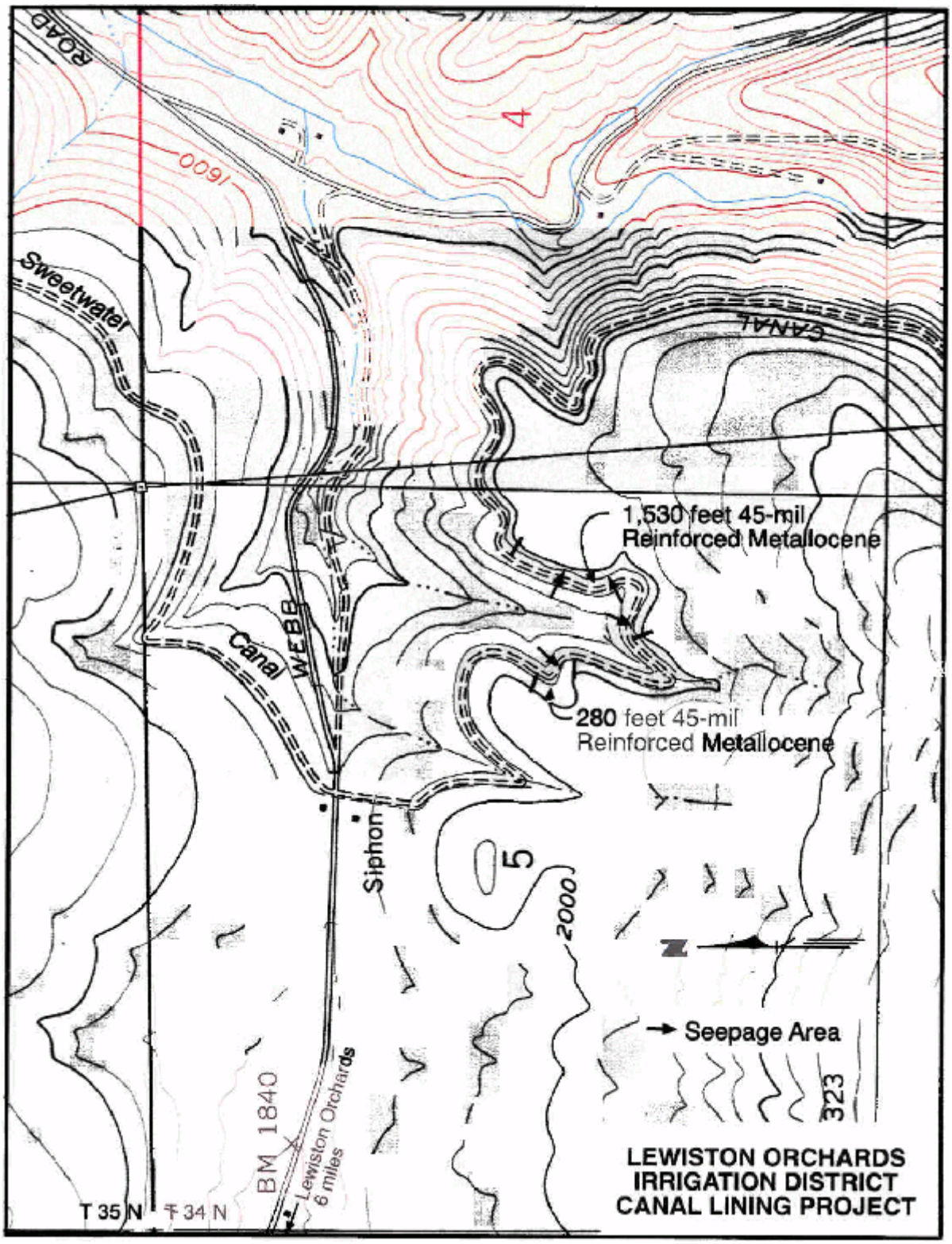


Figure 2 – Site location map.

An 8-man crew installed the geomembrane. The crew first rolled out the geotextile cushion in the road, and then pulled it into place. The crew then rolled out the geomembrane along the road, unfolded and pulled it into place, securing temporarily with 3/8 inch rebar bent into a 1-ft long pin. The trackhoe then covered the anchor berm with 6 to 12 inches of cover soil and rock. The geomembrane panels were shingled downstream, overlapped 1 to 2 feet, and welded with hot-air gun and hand roller. Prior to seaming, the geomembrane was cleaned with wet cloth. Serrot provided a master welder (Jose Avalos).

The first 600 feet of canal was quite rocky and was covered with a 16-oz geotextile cushion or excess scraps of Metallocene. The rest of the canal was much smoother and cushion was placed in the invert only. Because of the liner flexibility, only the rockiest sections really needed the cushion. The cost estimate assumes an 8-oz geotextile cushion used everywhere.

Difficulties: Wedge welder would not work on steep sideslopes and over the rough subgrade. Also problems with water in the canal invert. Performed welding on 2- by 8-ft sheets of plywood to get liner up out of the mud. In the worst areas, we had to use pump or wet-vac to dry out the canal invert prior to seaming. Seaming is a highly specialized skill, and more difficult than it appear. The ability of district personal to learn this skill on a short-term project is questionable. Because of employee turnover, continuing available of trained personnel on future jobs is also questionable.

Unit Cost Estimate: Exposed 45-mil Reinforced Metallocene with 8-oz Geotextile Cushion = $0.99 per square foot.
($0.39 Metallocene + 0.10 Geotextile cushion + 0.26 surface prep + 0.10 installation +17% OH and profit)

Advantages: The liner is very flexible and conforms to the subgrade easily. The 100-ft panels were easy to pull into place. A couple of panels were cut to fit around sharp bends in the canal, leaving welded seams every 50 to 100 feet. To minimize seaming, on long sweeping bends the liner was pleated and folded downstream. The only heavy equipment required was the trackhoe for performing subgrade preparation, and unloading and pre-positioning the rolls of geomembrane and geotextile cushion. The district should be able to perform minor repairs using a $500 hot air welder.

Disadvantages: Because the panels were fabricated into 30-ft widths and the canal prism varied from 20 to 24 feet, a lot of excess material was trimmed and wasted. The excess material was used as cushion in the invert, but it makes a very expensive cushion compared to 8 oz geotextile. Also need a skilled welder at $500+ per day to perform the field seams and train district personnel.

Photographs: 1-22

Photograph 1 - Preconstruction conditions at Lewiston Orchards. Subgrade consists of angular volcanic basalt.

Photograph 2 - Irrigation district removed a couple of abandoned pipe crossings to facilitate lining installation.

Photograph 3 - Trackhoe reshapes the canal prism, restoring the 1½:1 sideslopes.

Photograph 4 - Trackhoe cuts 3-ft anchor berm into both banks.

Photograph 5 - Trackhoe positions roll of geotextile cushion along the access road.

Photograph 6 - Geotextile cushion has been placed in the canal invert. Installation crew unrolls the Metallocene in the access road.

Photograph 7 - Crew unfolds the Metallocene and pulls the panel into place.

Photograph 8 - Installation crew pulls the Metallocene up the far bank and into final position.

Photograph 9 - At the downstream end, the liner is placed into a 3-ft deep cut-off trench.

Photograph 10 - Liner is ready for seaming.

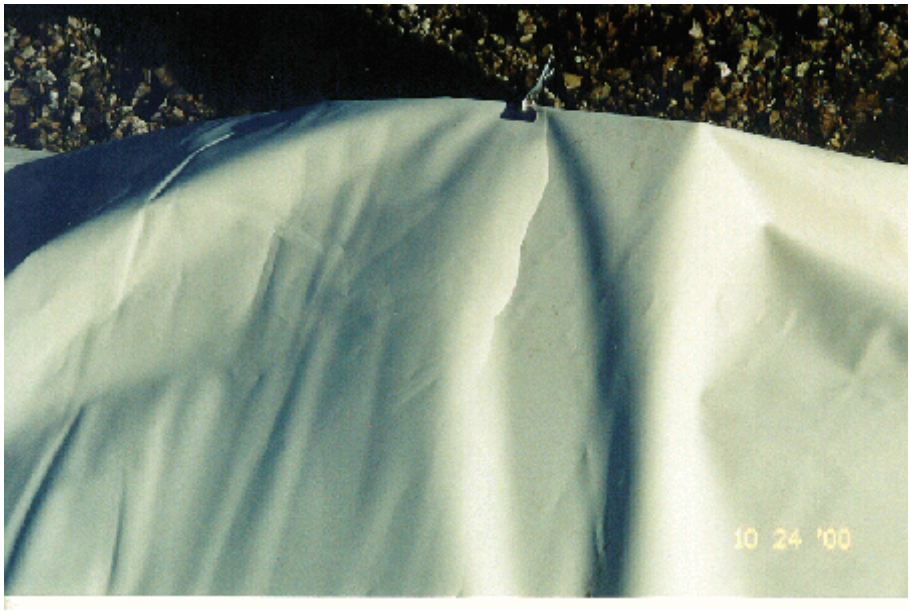
Photograph 11 - Liner is temporarily secured on the anchor berm with #3 rebar stakes.

Photograph 12 - To minimize seaming, liner was folded around bends in canal alignment.

Photograph 13 - Wet-Dry Vac used to remove ponded water prior to seaming.

Photograph 14 - Overlapped seams are cleaned to remove dirt and mud prior to seaming.

Photograph 15 - Master welder from Serrot uses hot-air welder to seam the Metallocene.



Photograph 16 - Plywood (not visible) is temporarily placed under liner to provide firm surface for seaming. Overlapped seams are clamped into final position for seaming.

Photograph 17 - As the seaming is completed, the plywood is removed.

Photograph 18 - Master welder places a large patch over a problem seam (too much water).

Photograph 19 - Irrigation district personnel are trained in proper seaming technique for any future repairs.

Photograph 20 - Trackhoe places cover material over the far anchor berm.

Photograph 21 - Additional road base was imported to restore the access road and to cover the near anchor berm.

Photograph 22 - Finished Metallocene installation.

Appendix A

Material Data Sheet

Serrot 45-mil Reinforced Metallocene (mPE)

English

Reinforced Metallocene (mPE)

Serrot's mPE is a reinforced flexible polypropylene geomembrane produced from first quality resins. Serrot mPE contains a weft-inserted, polyester scrim reinforcement, which enhances tear and puncture resistance without reducing environmental stress crack resistance. Such properties make mPE ideal for floating covers and any applications requiring exceptional support in high-tensioned areas. mPE geomembranes are very flexible, durable, and have been formulated to be resistant to chemicals, ultraviolet degradation, and aging. mPE is formulated to be welded directly to HDPE or LLDPE. Serrot mPE is manufactured in black/black and tan/black. [6,7]

Property	Test Method	Frequency[1]	RPP36	RPP45
Thickness (nominal)[2] (mils) Thickness (minimum)[3] (mils)	D751/D5199	per roll	36 34	45 41
Weight per Unit Area (g/sf)	D5261	50,000 SF	68	82
Tensile Properties • Grab Strength (lb/4") • Grab Elongation (%)	D751	50,000 SF	 225 22	 250 22
Tear Resistance[4] (min. ave.) (lb)	D5884 (2 ipm)	50,000 SF	65	65
Ply Adhesion[4] (lb or FTB)	D413	50,000 SF	20	20
Puncture Resistance (min. ave.) (lb)	D4833 FTMS 101B/ Method 2031[5]	50,000 SF Certified	85 200	90 250
Dimensional Stability (max)(%)	D1204	Resin Batch	±1.0	±1.0
Hydrostatic Resistance (psi)	D751 Method A, Proc. 1	Certified	300	350
Low Temp Flexibility	D2136 1/8" Mandrel, 4 Hrs	Certified	-40ºF	-40ºF
Stress Crack Resistance (hrs)	D1693	Certified	5,000	5,000
UV Resistance (hrs)	QUV	Certified	5,000	5,000
Reinforcing Scrim	9 x 9, 1000 denier weft-inserted polyester for all material thicknesses			

[1]Testing frequencies are rounded to the nearest full roll.
[2]Nominal thickness is based on no coupon being less than 10% under specified thickness. Average thickness may be less than specified thickness.
[3]Minimum thickness is based on average thickness being equal to or greater than specified thickness
[4]Peak value.
[5]FTMS 101b has been replaced with D4833. Value shown for comparison purposes only.
[6]RPP black/black and tan/black is available in accordance with ANSI/NSF 61 standard and can be used for both potable and industrial applications.
[7]Allow four (4) months lead time to fully evaluate long term UV resistance of the color.

RPPE 10/25/00

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